1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^3 - 21x^2 - 14x + 40$$

A. $z_1 \in [-1.38, -0.8]$, $z_2 \in [1.53, 1.81]$, and $z_3 \in [1.79, 2.07]$

B. $z_1 \in [-5.06, -4.9]$, $z_2 \in [-2.45, -1.94]$, and $z_3 \in [0.12, 0.65]$

C. $z_1 \in [-2.51, -1.83]$, $z_2 \in [-0.61, -0.47]$, and $z_3 \in [0.65, 1]$

D. $z_1 \in [-1.15, -0.16]$, $z_2 \in [0.22, 0.94]$, and $z_3 \in [1.79, 2.07]$

E. $z_1 \in [-2.51, -1.83]$, $z_2 \in [-1.7, -1.2]$, and $z_3 \in [1.02, 1.56]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 + 28x^2 - 39}{x + 3}$$

A. $a \in [3, 15], b \in [2, 7], c \in [-16, -7]$, and $r \in [-7, 5]$.

B. $a \in [-28, -22], b \in [98, 105], c \in [-302, -297]$, and $r \in [859, 863]$.

C. $a \in [3, 15], b \in [-7, 1], c \in [13, 19]$, and $r \in [-105, -99]$.

D. $a \in [-28, -22], b \in [-49, -43], c \in [-136, -131]$, and $r \in [-440, -428]$.

E. $a \in [3, 15], b \in [51, 53], c \in [153, 159]$, and $r \in [428, 432]$.

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3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 + 72x^2 + 28x - 20}{x + 3}$$

A. $a \in [-68, -56]$, $b \in [-109, -105]$, $c \in [-301, -291]$, and $r \in [-908, -906]$.

B. $a \in [16, 24]$, $b \in [-10, -7]$, $c \in [58, 62]$, and $r \in [-260, -257]$.

C. $a \in [-68, -56]$, $b \in [251, 256]$, $c \in [-734, -727]$, and $r \in [2164, 2169]$.

D. $a \in [16, 24]$, $b \in [132, 136]$, $c \in [423, 428]$, and $r \in [1250, 1260]$.

E. $a \in [16, 24]$, $b \in [7, 19]$, $c \in [-8, -3]$, and $r \in [-1, 8]$.

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4. Factor the polynomial below completely, knowing that $x + 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 + 11x^3 - 257x^2 + 297x - 90$$

A. $z_1 \in [-3.8, -1.7]$, $z_2 \in [-1.96, -1.25]$, $z_3 \in [-1.68, -1.5]$, and $z_4 \in [4.1, 6.1]$

B. $z_1 \in [-3.8, -1.7]$, $z_2 \in [-0.82, 0.09]$, $z_3 \in [-0.64, -0.29]$, and $z_4 \in [4.1, 6.1]$

C. $z_1 \in [-5.1, -3.6]$, $z_2 \in [1.23, 1.89]$, $z_3 \in [1.46, 1.93]$, and $z_4 \in [1.7, 3.8]$

D. $z_1 \in [-3.8, -1.7]$, $z_2 \in [-2.05, -1.98]$, $z_3 \in [-0.45, 0.33]$, and $z_4 \in [4.1, 6.1]$

E. $z_1 \in [-5.1, -3.6]$, $z_2 \in [-0.33, 1.48]$, $z_3 \in [0.44, 0.93]$, and $z_4 \in [1.7, 3.8]$

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5. Factor the polynomial below completely, knowing that $x + 2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^4 + 103x^3 + 126x^2 - 27x - 54$$

A. $z_1 \in [-0.33, 0.04]$, $z_2 \in [1.62, 2.17]$, $z_3 \in [2.32, 3.41]$, and $z_4 \in [2.81, 3.25]$

B. $z_1 \in [-3.06, -2.84]$, $z_2 \in [-2.02, -1.92]$, $z_3 \in [-1.34, -0.98]$, and $z_4 \in [1.44, 1.82]$

C. $z_1 \in [-3.06, -2.84]$, $z_2 \in [-2.02, -1.92]$, $z_3 \in [-1.15, -0.65]$, and $z_4 \in [-0.07, 0.95]$

D. $z_1 \in [-1.75, -1.29]$, $z_2 \in [1.23, 1.53]$, $z_3 \in [1.95, 2.57]$, and $z_4 \in [2.81, 3.25]$

E. $z_1 \in [-0.71, -0.58]$, $z_2 \in [0.64, 1.05]$, $z_3 \in [1.95, 2.57]$, and $z_4 \in [2.81, 3.25]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 + 101x^2 + 138x + 45}{x + 5}$$

A. $a \in [-75, -72]$, $b \in [475, 477]$, $c \in [-2245, -2240]$, and $r \in [11253, 11258]$.

B. $a \in [14, 16]$, $b \in [10, 15]$, $c \in [69, 78]$, and $r \in [-389, -378]$.

C. $a \in [14, 16]$, $b \in [174, 179]$, $c \in [1017, 1022]$, and $r \in [5131, 5139]$.

D. $a \in [14, 16]$, $b \in [25, 33]$, $c \in [4, 9]$, and $r \in [1, 8]$.

E. $a \in [-75, -72]$, $b \in [-279, -271]$, $c \in [-1234, -1227]$, and $r \in [-6115, -6111]$.

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7. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^3 - 26x^2 - 5x + 50$$

A. $z_1 \in [-0.81, -0.3]$, $z_2 \in [0.3, 1.8]$, and $z_3 \in [1.68, 2.12]$

B. $z_1 \in [-5.59, -4.51]$, $z_2 \in [-2.3, -1.5]$, and $z_3 \in [0.41, 0.68]$

C. $z_1 \in [-1.3, -1.01]$, $z_2 \in [1.6, 2.8]$, and $z_3 \in [2.49, 2.51]$

D. $z_1 \in [-2.4, -1.96]$, $z_2 \in [-0.8, -0.2]$, and $z_3 \in [0.76, 1.14]$

E. $z_1 \in [-2.51, -2.08]$, $z_2 \in [-2.3, -1.5]$, and $z_3 \in [1.22, 1.38]$

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8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 3x^3 + 6x^2 + 2x + 5$$

A. $\pm 1, \pm 3$

B. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 5}$

C. $\pm 1, \pm 5$

D. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 3}$

E. There is no formula or theorem that tells us all possible Rational roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{4x^3 - 14x^2 + 21}{x - 3}$$

A. $a \in [11, 17], b \in [17, 23], c \in [57, 72],$ and $r \in [217, 221]$.

B. $a \in [3, 7], b \in [-6, -4], c \in [-16, -7],$ and $r \in [-8, -1]$.

C. $a \in [3, 7], b \in [-3, 1], c \in [-7, -3],$ and $r \in [-2, 4]$.

D. $a \in [11, 17], b \in [-55, -47], c \in [150, 152],$ and $r \in [-436, -428]$.

E. $a \in [3, 7], b \in [-28, -21], c \in [74, 79],$ and $r \in [-215, -210]$.

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10. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 4x^2 + 7x + 7$$

A. $\pm 1, \pm 2, \pm 4$

B. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 4}$

C. $\pm 1, \pm 7$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 7}$

E. There is no formula or theorem that tells us all possible Integer roots.
